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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/678,699

10/03/2003

Wen Chin Lin

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EXAMINER

NGUYEN, DANG T

ART UNIT

PAPER NUMBER

2824

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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3 MONTHS

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/678,699

Applicant(s)

LIN ET AL.

Examiner

Dang T. Nguyen

Art Unit

2824

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 10/18/2006 of Applicant's Amendments.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 11 - 15, 17, 18 - 23 and 25 - 32 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 11 - 15, 17, 18 - 23 and 25 - 32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☒ Other: Search history.

***Response to Amendment***

1. This action is responsive to applicant's amendment filed on 10/18/06. Claims 1 - 7, 18 - 23, 28 - 30, and 35 - 37 are pending in this application. Claims 11, 18 and 27 have been amended. Claims 1 - 10, 16, 19 and 24 have been cancelled. Claims 11 - 15, 17, 18 - 23 and 25 - 32 are pending on this application. Claims 11, 18 and 27 are independent claims.

***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**Claims 11 - 13, 17 - 18, 20, 25, 26 and 27 - 32 are rejected under 35**

**U.S.C. 103(a) as being unpatentable over Zhu, Patent No. 5,930,164 B1 - Date of Patent: Feb. 26, 1998 in view of Tran et al., Pub. No.: US 2004/0042264 A1 - filed (9/3/2002).**

**Regarding independent claim 11,** Fig. 1 of Zhu discloses a magnetic memory cell comprising a switching element and a magnetic tunnel junction (MTJ) configuration comprising:

a first MTJ device [11] including a first free layer [112], a first tunneling barrier [113], and a first pinned layer [111];

a second MTJ device including a second free layer [122], a second tunneling barrier [123], and a second pinned layer [121]; and

a first conductor [13] connecting the first [11] and second [12] MTJ devices;

wherein a first magneto-resistance of the first MTJ device is different from a second magneto-resistance of the second MTJ device (Col. 2 line 53 – Col. 3 line 2). However Zhu fails to disclose wherein the second tunneling barrier is comprised of a different material than the first tunneling barrier.

Fig. 1 of Tran discloses the first MTJ [10] comprises a first tunneling barrier [16] and the second MTJ [20] comprise a second tunneling barrier [24] and they are made by different materials (Page 1, paragraph [0015])

Zhu and Tran are common subject matter for magnetic tunnel junction. Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporated the different materials of tunnel barrier of Tran into the magnetic tunnel junction of Zhu for the purpose of increasing storage capacity and reducing storage cost (Page 1, paragraph [0002]).

**Regarding dependent claim 12**, Zhu discloses the memory cell of claim 11 wherein the second magneto-resistance is twice of the first magnetic resistance (Col. 6 lines 46-47).

**Regarding dependent claim 13**, Fig. 1 of Zhu discloses the memory cell of claim 11 wherein the second MTJ device includes an anti-ferromagnetic material and wherein the first free layer is connected to the anti-ferromagnetic material through the first conductor (Col. 1 lines 31-34).

**Regarding dependent claim 17**, Fig. 1 of Zhu discloses the memory cell of claim 11 wherein the first tunneling barrier [113] is formed from a different processing recipe than the second tunneling layer [123] (Col. 2 line 60 - 66).

**Regarding independent claim 18**, Figs. 1 - 3 of Zhu disclose an integrated circuit comprising:

an input/output section (Fig. 3 [33]);

a plurality of logic circuits (Fig. 3 [W1, W2]) connected to the input/output section (Col. 4 lines 65-67); and

a plurality of magnetic memory cells (Fig. 3 [34 and 35]) connected to the logic circuits (Fig. 3 [W1, W2]) and (Col. 4 lines 65-67), the magnetic memory cells (Fig. 3 [34 and 35]) including a transistor (Fig. 3 [37 - 39]) and a storage structure (see Fig. 1) including:

a first MTJ device [11] including a first free layer [112], a first tunneling barrier [113], and a first pinned layer [111];

a second MTJ device including a second free layer [122], a second tunneling barrier [123], and a second pinned layer [121]; and

a first conductor [13] connected to configure the first [11] and second [12] magnetic junction devices in parallel (Col. 5 line 62);

wherein a first magneto-resistance ratio of the first MTJ device is different from a second magneto-resistance ratio of the second MTJ device (Col. 2 line 53 - Col. 3 line 2). However Zhu fails to disclose wherein the second tunneling barrier is comprised of a different material than the first tunneling barrier.

Fig. 1 of Tran discloses the first MTJ [10] comprises a first tunneling barrier [16] and the second MTJ [20] comprise a second tunneling barrier [24] and they are made by different materials (Page 1, paragraph [0015])

Zhu and Tran are common subject matter for magnetic tunnel junction. Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporated the different materials of tunnel barrier of Tran into the magnetic tunnel junction of Zhu for the purpose of increasing storage capacity and reducing storage cost (Page 1, paragraph [0002]).

**Regarding dependent claim 20**, Fig. 1 of Zhu discloses the integrated circuit of claim 18 wherein the second magnetic junction device [12] includes an anti-ferromagnetic material [121] (Col. 6 lines 40-41) and wherein the first free layer [112] is connected to the anti-ferromagnetic material [121] through the first conductor [13].

**Regarding dependent claim 25**, Fig. 1 of Zhu discloses the memory cell of claim 18 wherein the first tunneling barrier [113] is formed from a different processing recipe than the second tunneling layer [123] (Col. 2 line 60 - 66).

**Regarding dependent claim 26**, Fig. 1 of Zhu discloses the integrated circuit of claim 18 wherein the first magneto-resistance ratio of the first tunneling barrier [113] is 50-60% (Zhu discloses a first barrier [113] has a thickness of 22-30 Angstrom) and the second magneto-resistance ratio of the second tunneling barrier [123] is 20-30% (Zhu discloses a second barrier [123] has a thickness of 15-22 Angstrom) (Col. 2 lines 50-51 and 60-61, similar to 50% different ratio between first and second magneto-resistance).

**Regarding independent claim 27**, Fig. 1 of Zhu discloses an apparatus, comprising:

a first magnetic tunnel junction [11] having a first magneto-resistance ratio of 50-60% (Col. 2 lines 50-51); and a second magnetic tunnel junction [12] having a second magneto-resistance ratio 20-30% (Col. 2 lines 60-61), wherein: the first and second magnetic tunnel junctions [11 and 12] are electrically connected; However Zhu fails to disclose the first magneto-resistance ratio of 50-60%; and the second magneto-resistance ratio of 20-30%. It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide an improved MRAM device having a high speed operation, high density memory capacity and a low power consumption, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

**Regarding dependent claim 28**, Zhu discloses the apparatus of claim 27 wherein the first magneto-resistance ratio is about 50% of the second magneto-resistance ratio (Col. 2 lines 50-51 and 60-61).

**Regarding dependent claim 29**, Fig. 1 of Zhu discloses the apparatus of claim 27 wherein:

the first magnetic tunnel junction [11] has a first tunnel barrier [113] having a first composition;

the second magnetic tunnel junction [12] has a second tunnel barrier [123] having a second composition; and the first and second compositions are different (Col.

1 line 66 – col. 2 line 2).

**Regarding dependent claim 30**, Fig. 1 of Zhu discloses the apparatus of claim 27 wherein a first magnetic layer [112] of the first magnetic tunnel junction [11] is located between the second magnetic tunnel junction [12] and a second magnetic layer [113] of the first magnetic tunnel junction [11].

**Regarding dependent claim 31**, Fig. 1 of Zhu discloses the apparatus of claim 27 wherein no magnetic layer [13] of the first magnetic tunnel junction [11] is located between the second magnetic tunnel junction [12] and any other magnetic layer [112] of the first magnetic tunnel junction [11].

**Regarding dependent claim 32**, Fig. 1 of Zhu discloses the apparatus of claim 27 wherein:

the first magnetic tunnel junction [11] comprises a pinned layer [111], a first free layer [112], and a first tunnel barrier [113] located between the pinned layer [111] and the first free layer [112]; and

the second magnetic tunnel junction [12] comprises the first free layer [112], a second free layer [122], and a second tunnel barrier [123] located between the first and second free layers [112 and 122].

**3. Claims 14 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhu, Patent No. 5,930,164 B1 in view of Tran et al., Pub. No.: US 2004/0042264 A1 and further view of Ohtani, Pub. No.: US 2004/0052106 A1, Pub. Date: Mar. 18, 2004.**



**Regarding dependent claims 14 and 21**, Zhu and Tran as applied to claims 11 and 18 above, disclose every aspect to applicant's claimed invention except for a second conductor connected to the second free layer; wherein the first conductor connects to the first free layer; and wherein the first and second magnetic junction devices can be simultaneously written to using the second and first conductors respectively.

Figs. 2 and 6 of Ohtani disclose a second conductor [PL] connected to the second free layer [18]; wherein the first conductor [PL] connects to the first free layer [18]; and wherein the first [13] and second [14] magnetic junction devices can be simultaneously written to using the second and first conductors [PL's] respectively (Page 4, paragraph [0046] lines 1-4).

Zhu, Tran and Ohtani are common subject matter for Magnetic Tunnel Junction. Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate Ohtani's conductor into the integrated circuit of Zhu and Tran for the purpose of performing the writing of signals to first and second tunneling magneto-resistance elements more rapidly (Abstract, lines 7-9).

**4. Claims 15 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhu, Patent No. 5,930,164 B1 in view of Tran et al., Pub. No.: US 2004/0042264 A1 and further view of Gill, Patent No.: US 6,185,080, Date of Patent: Feb. 6, 2001.**

**Regarding dependent claims 15 and 22**, Zhu and Tran as applied to claims 11 and 18 above, disclose every aspect to applicant's claimed invention except for wherein at least one of the free layers includes a spacer sandwiched between two ferromagnetic layers and the spacer.

Fig. 13 of Gill discloses at least one of the free layers [205 or 235] includes a spacer [210 or 230] sandwiched between two ferromagnetic layers ([82 and 229] or [80 and 217], Col. 7 lines 35 and Col. 10 line 1-2).

Zhu, Tran and Gill are common subject matter for Magnetic Tunnel Junction. Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the free layers includes a spacer of Gill into the memory cell of Zhu and Tran for the purpose of increasing the effect of the sensor when the magnetic moment of the free layers rotate (Col. 2 lines 29-30).

**5. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zhu, Patent No. 5,930,164 B1 in view of Tran et al., Pub. No.: US 2004/0042264 A1, further view of Gill, Patent No.: US 6,185,080 and further view of Chen, Patent No.: US 6,469,926 B1 – Date of Patent: Oct. 22, 2002.**

**Regarding dependent claim 23**, Zhu, Tran and Gill as applied to claims 22 above, discloses every aspect to applicant's claimed invention except for the spacer comprises a synthetic anti-ferromagnetic material.

Fig. 3 of Chen discloses the spacer [50] comprises in a synthetic anti-ferromagnetic material (Col. 2 lines 66-67).

Zhu, Tran, Gill and Chen are common subject matter for Magnetic Tunnel Junction. Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate Chen's synthetic anti-ferromagnetic material into Zhu, Tran and Gill's spacer for the purpose of improving magnetoresistance ratio and a decrease in voltage dependence (Abstract, lines 14-17).

### ***Response to Arguments***

6. Applicant's arguments with respect to claims 11, 18 and 27 have been considered but that teaches by a second reference (Tran et al.) and are moot in view of the new ground(s) of rejection.

### ***Prior art***

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Costrini et al. Pub. No.: US 2004/0087038 A1 Pub. Date: May. 6, 2004

### ***Conclusion***

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

#### **Contact Information**

9. Any inquiry concerning this communication from the examiner should be directed to Dang Nguyen, who can be reached by telephone at (571) 272-1955. Normal contact times are M-F, 8:00 AM - 4:30 PM.

Upon an unsuccessful attempt to contact the examiner, the examiner's supervisor, Richard Elms, may be reached at (571) 272-1869.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist, whose telephone number is (703) 305-3900. The faxed phone number for organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the Status of an application may be obtained from the patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status

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information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free) or [EBC@uspto.gov](mailto:EBC@uspto.gov).

Dang Nguyen 12/1/2006

A handwritten signature in black ink, appearing to read 'Anh Phung', written in a cursive style.

**ANH PHUNG  
PRIMARY EXAMINER**